

In the Claims:

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(Please amend claims 1, 6, 8, 10, 14, 15, 16, 17, 19,
24, 27, 29, 31, 33, 37 & 38 as set forth below. All the
claims are reproduced below for the Examiner's convenience.

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1. (Thrice Amended) A method for encoding a frame
having a plurality of macroblocks, said method comprising:

using intraframe statistics to determine without
reference to another frame whether said frame includes
a noisy portion, and if so, then for each macroblock of
said frame:

(i) determining a macroblock activity level;

(ii) determining when said macroblock
activity level exceeds a predefined threshold,
wherein said macroblock activity level exceeding
said predefined threshold indicates that said
macroblock is associated with said noisy portion
of said frame; and

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(iii) adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock by biasing coding of said macroblock associated with said noisy portion of said frame towards predictive coding and thereby save bits otherwise used to encode said noisy portion of said frame and provide a more constant picture quality due to encoding of the frame.

2. The method of claim 1, wherein said frame further comprises a normal portion, and wherein said method comprises using said saved bits from said noisy portion of said frame to encode macroblocks associated with said normal portion of said frame.

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3. The method of claim 1, wherein each macroblock of said plurality of macroblocks comprises multiple blocks, and wherein said determining (i) comprises determining an activity level for each block of said multiple blocks of said macroblock, and deriving therefrom an activity level for said macroblock.

4. The method of claim 3, wherein said deriving comprises ordering activity levels of said multiple blocks of said macroblock and comparing a minimum activity level of said order with a next to minimum activity level of said order to derive said activity level for said macroblock.

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5. The method of claim 4, wherein said comparing further comprises comparing said minimum activity level of said order with an average activity level of said multiple blocks of said macroblock to derive said activity level for said macroblock.

6. (Twice Amended) A method for encoding a frame having a plurality of macroblocks, said method comprising:

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determining whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

(i) determining a macroblock activity level;

(ii) determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

(iii) adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock and thereby save bits otherwise used to encode said noisy portion of said frame;

wherein each macroblock of said plurality of macroblocks comprises multiple blocks, and wherein said determining (i) comprises determining an activity level for each block of said multiple blocks of said macroblock, and deriving therefrom an activity level for said macroblock;

wherein said deriving comprises ordering activity levels of said multiple blocks of said macroblock and comparing a minimum activity level of said order with a next to minimum activity level of said order to derive said activity level for said macroblock;

wherein said comparing further comprises comparing said minimum activity level of said order with an average activity level of said multiple blocks of said macroblock to derive said activity level for said macroblock; and

wherein said comparing comprises determining whether said minimum activity level is less than one-half said next to minimum activity level and whether said minimum activity level is less than one-half said average activity level of said multiple blocks, and when both are so, defining said activity level of said macroblock as said next to minimum activity level of said order, otherwise defining said activity level of said macroblock as said minimum activity level of said order.

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7. The method of claim 1, wherein said adjusting encoding (iii) comprises performing motion estimation on said macroblock and selectively adjusting macroblock coding type for said macroblock to bias said macroblock towards being coded predictive when said macroblock activity level exceeds said predefined threshold, said selectively adjusting being with reference to a predictive error value resulting from said performing motion estimation on said macroblock.

8. (Twice Amended) A method for encoding a frame having a plurality of macroblocks, said method comprising:

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using intraframe statistics to determine without reference to another frame whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

(i) determining a macroblock activity level;

(ii) determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

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(iii) adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock and thereby save bits otherwise used to encode said noisy portion of said frame;

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wherein said adjusting encoding (iii) comprises performing motion estimation on said macroblock and selectively adjusting macroblock coding type for said macroblock to bias said macroblock towards being coded predictive when said macroblock activity level exceeds said predefined threshold, said selectively adjusting being with reference to a predictive error value resulting from said performing motion estimation on said macroblock; and

wherein said selectively adjusting comprises determining when said predictive error is greater than a second predefined threshold and said predictive error is greater than one-half said macroblock activity level, and when both are so, adjusting a macroblock coding type parameter to bias said macroblock towards being coded predictive.

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9. The method of claim 1, wherein said adjusting encoding (iii) comprises determining an adjusted quantization level for use in encoding said macroblock, said adjusted quantization level being determined to conserve bits used in encoding said macroblock when said macroblock activity level exceeds said predefined threshold.

10. (Twice Amended) A method for encoding a frame having a plurality of macroblocks, said method comprising:

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using intraframe statistics to determine without reference to another frame whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

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(i) determining a macroblock activity level;

(ii) determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

(iii) adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock and thereby save bits otherwise used to encode said noisy portion of said frame;

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wherein said adjusting encoding (iii) comprises determining an adjusted quantization level for use in encoding said macroblock, said adjusted quantization level being determined to conserve bits used in encoding said macroblock when said macroblock activity level exceeds said predefined threshold; and

wherein said determining of said adjusted quantization level comprises calculating a quantization level (CAL QL) for said macroblock and defining said adjusted quantization level (ADJ QL) as:

$$ADJ\ QL = \min((1 + 0.25 (TH2 - BR + 1)) \cdot CAL\ QL; \text{MAX ALLOWED BY STANDARD})$$

Where: BR is the target bitrate;

TH2 is a second predefined value; and

MAX QL ALLOWED BY STANDARD is a maximum quantization level allowed by MPEG standard

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12. The method of claim 1, wherein said determining whether said frame comprises said noisy portion includes calculating a frame complexity value and comparing said frame complexity value to a predefined complexity threshold.

13. The method of claim 12, wherein said frame comprises a plurality of pixels, and wherein each pixel of said frame comprises a multi-bit value, and wherein said frame complexity value comprises an accumulated absolute difference value (PIX-DIFF) derived from adjacent pixels of said plurality of pixels of said frame.

14. (Twice Amended) A method for encoding a frame having a plurality of macroblocks, said method comprising:

using intraframe statistics to determine without reference to another frame whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

(i) determining a macroblock activity level;

(ii) determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

(iii) adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock and thereby save bits otherwise used to encode said noisy portion of said frame;

wherein said determining whether said frame comprises said noisy portion includes calculating a frame complexity value and comparing said frame complexity value to a predefined complexity threshold;

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wherein said frame comprises a plurality of pixels, and wherein each pixel of said frame comprises a multi-bit value, and wherein said frame complexity value comprises an accumulated absolute difference value (PIX-DIFF) derived from adjacent pixels of said plurality of pixels of said frame; and

wherein said PIX-DIFF is defined as:

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$$\sum |L_y - L_{y+1}|$$

y=1,3,5...

Where: L represents luminance value of a pixel, and y represents pixel position within the frame.

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15. (Twice Amended) The method of claim 13, further comprising setting a noisy picture flag to "0" when said frame complexity value is less than said predefined complexity threshold, wherein said flag set to "0" designates said frame as a non-noisy or normal frame.

16. (Twice Amended) The method of claim 13, wherein said determining whether said frame comprises said noisy portion further includes comparing a target bitrate for said frame to a predefined bitrate threshold and when said target bitrate for said frame exceeds said predefined bitrate threshold, said method further comprises setting a noisy picture flag equal to "0", wherein said flag set to "0" designates said frame as a non-noisy or normal frame, and if said target bitrate is less than said predefined bitrate threshold, then setting said noisy picture flag to "1", wherein said "1" noisy picture flag setting indicates said frame includes said noisy portion.

17. (Twice Amended) A method for encoding a frame of a sequence of frames, each frame having a plurality of macroblocks, said method comprising:

using intraframe statistics to determine without reference to another frame whether said frame includes a random noise portion; and

when said frame includes said random noise portion, evaluating each macroblock of said plurality of macroblocks in said frame and adjusting encoding of at least some macroblocks thereof within said random noise portion of said frame, said adjusting comprising reducing bits used in encoding said at least some macroblocks within said random noise portion by biasing coding thereof towards predictive coding.

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18. The method of claim 17, wherein each frame of the sequence of frames comprises a plurality of pixels, each pixel of each frame comprising a multi-bit value, and wherein said determining whether said frame includes said random noise portion includes calculating a frame complexity value and comparing said frame complexity value to a predefined complexity threshold, said calculating of said frame complexity value including deriving an accumulated absolute difference (PIX-DIFF) from adjacent pixels of said plurality of pixels of said frame.

19. (Twice Amended) A method for encoding a frame of a sequence of frames, each frame having a plurality of macroblocks, said method comprising:

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determining whether said frame includes a random noise portion; and

when said frame includes said random noise portion, evaluating each macroblock of said plurality of macroblocks in said frame and adjusting encoding of at least some macroblocks thereof within said random noise portion of said frame, said adjusting comprising reducing bits used in encoding said at least some macroblocks within said random noise portion;

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wherein each frame of the sequence of frames comprises a plurality of pixels, each pixel of each frame comprising a multi-bit value, and wherein said determining whether said claim includes said random noise portion includes calculating a frame complexity value and comparing said frame complexity value to a predefined complexity threshold, said calculating of said frame complexity value including deriving an accumulated absolute difference (PIX-DIFF) from adjacent pixels of said plurality of pixels of said frame; and

wherein said deriving of said PIX-DIFF comprises forming a string of pixels by concatenating said plurality of pixels of said frame and defining PIX-DIFF as:

$$\sum_{y=1,3,5,\dots}^{\text{Max}} |L_y - L_{y+1}|$$

Where: L represents luminance value of a pixel, and y represents pixel position within the string of pixels.

20. The method of claim 18, wherein when said frame complexity value is less than said predefined complexity threshold, said method further comprises setting a noisy picture flag to "0" and performing normal encoding on said frame, wherein said flag set to "0" designates said frame as a non-noisy or normal frame, and wherein when said frame complexity value is greater than said predefined complexity threshold, said method further comprises determining whether a target bitrate of said frame is less than a predefined bitrate threshold, wherein when said target bitrate of said frame exceeds said predefined bitrate threshold, said method comprises setting said noisy picture flag to "0", and when said target bitrate of said frame is less than said predefined bitrate threshold, said method comprises setting said noisy picture flag to "1", wherein said "1" noisy picture flag setting indicates that said frame includes said random noise portion.

21. The method of claim 17, wherein said evaluating comprises for each macroblock determining a macroblock activity level and determining when said macroblock activity level exceeds a predefined activity threshold, wherein said macroblock activity level exceeding said predefined activity threshold indicates that said macroblock is within said random noise portion of said frame.

22. The method of claim 21, wherein said adjusting encoding comprises performing motion estimation on said macroblock and selectively adjusting macroblock coding type for said macroblock to bias said macroblock towards being coded predictive when said macroblock activity level exceeds said predefined activity threshold, said selectively adjusting being with reference to a predictive error value resulting from said performing motion estimation on said macroblock, and further comprising determining an adjusted quantization level for said macroblock for use in encoding said macroblock, said adjusted quantization level being determined to reduce bits used in encoding said macroblock.

23. The method of claim 17, wherein said frame further includes a normal video portion, and said reducing bits comprises conserving bits used in encoding said at least some macroblocks within said random noise portion for use within said normal video portion of said frame.

24. (Thrice Amended) A system for encoding a frame comprising a plurality of macroblocks, said system comprising:

means for using intraframe statistics to determine without reference to another frame whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

(i) means for determining a macroblock activity level;

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(ii) means for determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

(iii) means for adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock by biasing coding of said macroblock associated with said noisy portion of said frame towards predictive coding and thereby save bits otherwise used to encode said noisy portion of said frame and provide a more constant picture quality due to encoding of the frame.

25. The system of claim 24, wherein said frame further comprises a normal portion, and wherein said system comprises means for using said saved bits from said noisy portion of said frame to encode macroblocks associated with said normal portion of said frame.

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26. The system of claim 24, wherein each macroblock of said plurality of macroblocks comprises multiple blocks, and wherein said means for determining (i) comprises means for determining an activity level for each block of said multiple blocks of said macroblock, and means for ordering activity levels of said multiple blocks of said macroblock and comparing a minimum activity level of said order with a next to minimum activity level of said order to derive an activity level for said macroblock.

27. (Twice Amended) A system for encoding a frame comprising a plurality of macroblocks, said system comprising:

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means for determining whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

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(i) means for determining a macroblock activity level;

(ii) means for determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

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(iii) means for adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock and thereby save bits otherwise used to encode said noisy portion of said frame;

wherein each macroblock of said plurality of macroblocks comprising multiple blocks, and wherein said means for determining (i) comprises means for determining an activity level for each block of said multiple blocks of said macroblock, and means for ordering activity levels of said multiple blocks of said macroblock and comparing a minimum activity level of said order with a next to minimum activity level of said order to derive an activity level for said macroblock; and

wherein said means for comparing comprises means for determining whether said minimum activity level is less than one-half said next to minimum activity level and whether said minimum activity level is less than one-half an average activity level of said multiple blocks, and when both are true, for defining said activity level of said macroblock as said next to minimum activity level in said macroblock, otherwise for defining said activity level of said macroblock as said minimum activity level of said order.

28. The system of claim 24, wherein said means for adjusting encoding (iii) comprises means for performing motion estimation on said macroblock and for selectively adjusting macroblock coding type for said macroblock to bias said macroblock towards being coded predictive when said macroblock activity level exceeds said predefined threshold, said selectively adjusting being with reference to a predictive error value resulting from said performing of motion estimation on said macroblock.

D9 29. (Twice Amended) A system for encoding a frame comprising a plurality of macroblocks, said system comprising:

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Cont means for determining whether said frame includes a noisy portion, and if so, then for each macroblock of said frame:

(i) means for determining a macroblock activity level;

(ii) means for determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

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(iii) means for adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock and thereby save bits otherwise used to encode said noisy portion of said frame;

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wherein said means for adjusting encoding (iii) comprises means for performing motion estimation on said macroblock and for selectively adjusting macroblock coding type for said macroblock to bias said macroblock towards being coded predictive when said macroblock activity level exceeds said predefined threshold, said selectively adjusting being with reference to a predictive error value resulting from said performing of motion estimation on said macroblock; and

wherein said means for selectively adjusting comprises means for determining when said predictive error is greater than a second predefined threshold and when said predictive error is greater than one-half said macroblock activity level, and when both are so, said means for selectively adjusting comprises means for adjusting a macroblock coding type parameter to bias said macroblock towards being coded predictive.

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30. The system of claim 29, wherein said means for adjusting encoding (iii) further comprises means for determining an adjusted quantization level for use in encoding said macroblock, said adjusted quantization level being determined to conserve bits used in encoding said macroblock when said macroblock activity level exceeds said predefined threshold.

31. (Twice Amended) A system for encoding a frame of a sequence of frames, each frame having a plurality of macroblocks, said system comprising:

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a pre-encode processing unit for using intraframe statistics to determine without reference to another frame whether said frame includes a random noise portion; and

a control and encode unit for evaluating each macroblock of said plurality of macroblocks in said frame when said frame includes said random noise portion, said control and encode unit including means for adjusting encoding of at least some macroblocks within said random noise portion of said frame to reduce bits used in encoding said at least some macroblocks within said random noise portion by biasing coding thereof towards predictive coding.

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32. The system of claim 31, wherein each frame of the sequence of frames comprises a plurality of pixels, each pixel of each frame comprising a multi-bit value, and wherein said pre-encode processing unit comprises means for deriving a frame complexity value and for comparing said frame complexity value to a predefined complexity threshold, said means for deriving of said frame complexity value including means for deriving an accumulated absolute difference (PIX-DIFF) from adjacent pixels of said plurality of pixels of said frame.

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33. (Twice Amended) The system of claim 32, wherein when said frame complexity value is less than said predefined complexity threshold, said pre-encode processing unit further comprises means for setting a noisy picture flag to "0" and performing normal encoding on said frame, wherein said flag set to "0" designates said frame as a non-noisy or normal frame, and when said frame complexity value is greater than said predefined complexity threshold, said pre-encode processing unit comprises means for determining whether a target bitrate of said frame is less than a predefined bitrate threshold, and when said target bitrate of said frame exceeds said predefined bitrate threshold, said pre-encode processing unit comprises means for setting said noisy picture flag to "0", and when said target bitrate of said frame is less than said predefined bitrate threshold, said pre-encode processing unit comprises means for setting said noisy picture flag to "1", wherein said "1" noisy picture flag setting indicates that said frame includes said random noise portion.

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34. The system of claim 33, wherein said control and encode unit further comprises means for determining for each macroblock a macroblock activity level and for determining when said macroblock activity level exceeds a predefined activity threshold, wherein said macroblock activity level exceeding said predefined activity threshold indicates that said macroblock is within said random noise portion of said frame.

35. The system of claim 34, wherein said means for adjusting encoding comprises means for performing motion estimation on said macroblock and means for selectively adjusting macroblock coding type for said macroblock to bias said macroblock towards being coded predictive when said macroblock activity level exceeds said predefined activity threshold, said means for selectively adjusting being with reference to a predictive error value resulting from performing motion estimation on said macroblock, and wherein said control and encode unit further comprises means for determining an adjusted quantization level for said macroblock for use in encoding said macroblock, said adjusted quantization level being determined to reduce bits used in encoding said macroblock.

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36. The system of claim 35, wherein said frame further includes a normal video portion, and said means for adjusting encoding comprises means for conserving bits used in encoding said at least some macroblocks within said random noise portion for use in encoding macroblocks within said normal video portion of said frame.

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37. (Thrice Amended) A computer program product comprising a computer usable medium having computer readable program code means therein for use in encoding a frame comprising a plurality of macroblocks, said computer readable program code means in said computer program product comprising:

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computer readable program code means for causing a computer to affect using intraframe statistics to determine without reference to another frame whether said frame includes a noisy portion, and if so, then for each macroblock of said frame said computer program comprises:

computer readable program code means for causing a computer to affect determining a macroblock activity level;

computer readable program code means for causing a computer to affect determining when said macroblock activity level exceeds a predefined threshold, wherein said macroblock activity level exceeding said predefined threshold indicates that said macroblock is associated with said noisy portion of said frame; and

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computer readable program code means for causing a computer to affect adjusting encoding of said macroblock when said macroblock activity level exceeds said predefined threshold to conserve bits used in encoding said macroblock by biasing coding of said macroblock associated with said noisy portion of said frame towards predictive coding and thereby save bits otherwise used to encode said noisy portion of said frame and provide a more constant picture quality due to encoding of the frame.

38. (Twice Amended) A computer program product comprising computer usable medium having computer readable program code means therein for use in encoding a frame of a sequence of frames, each frame having a plurality of macroblocks, said computer readable program code means in said computer program product comprising:

computer readable program code means for causing a computer to affect using intraframe statistics to determine without reference to another frame whether said frame includes a random noise portion; and

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computer readable program code means for causing a computer to affect evaluating each macroblock of said plurality of macroblocks in said frame and when said frame includes said random noise portion, adjusting encoding of at least some macroblocks within said random noise portion of said frame, said adjusting comprising reducing bits used in encoding said at least some macroblocks within said random noise portion by biasing coding thereof towards predictive coding.
